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**RESEARCH ARTICLE**

# Spatial and temporal variability of the two main catched species of an artisanal trap fishery in an oceanic island

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## Abstract

1. This study analysed the catches of trap fishing in the Canary Archipelago, NE Atlantic Ocean. This study was conducted from October 2016 to September 2017, April to November 2018 and September 2020, in five ports (San Cristóbal, Taliarte, Castillo del Romeral, Arguineguín and Mogán).
2. The primary gear were traps with small mesh size (31.6 mm) and large mesh size (50.8 mm). A total of 2587 small mesh size traps and 141 large mesh size traps were analysed from 20- to 130-m depth.
3. The main target species were *Dentex gibbosus* and *Stephanolepis hispidus*.
4. Catches of traps with large mesh size showed *D. gibbosus* above first maturity and *S. hispidus* in small mesh size traps. Both species exhibit larger specimens during reproductive periods.
5. The most effective traps for D. gibbosus (large mesh) were located on the western coast (>30-m depth), with the highest catch per unit of effort (CPUE) in Mogán (857.7 g trap$^{-1}$ day$^{-1}$). The most effective traps for S. hispidus (small mesh) were located in southern areas, especially in sandy habitats (124.9 g trap$^{-1}$ day$^{-1}$ in Castillo del Romeral, 102.9 g trap$^{-1}$ day$^{-1}$ in Arguineguín).
6. The highest catchability of *D. gibbosus* was observed in April (CPUE of 962.8 g trap$^{-1}$ day$^{-1}$), and the highest catchability of *S. hispidus* was found in June (CPUE of 165.9 g trap$^{-1}$ day$^{-1}$).
7. The traps with small mesh size showed a great selectivity of sizes for *S. hispidus*; though high catch rates of immature specimens of *D. gibbosus* pose a threat to species conservation.
8. The management recommendations' proposed measures include revising minimum catch sizes for both species. Additionally, we suggested depth limitations for mesh sizes of traps.
9. The study highlights the need for new management strategies to ensure the conservation of targeted demersal species, with special emphasis on addressing the threat posed by small mesh sizes to immature *D. gibbosus*.

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10. The findings provide valuable insights for adapting fishery management practices to sustainably conserve the targeted species in the Canary Archipelago.

**KEYWORDS**

artisanal fishery, commercial fish, *Dentex gibbosus*, Gran Canaria, NE Atlantic Ocean, *Stephanolepis hispidus*

## 1 | INTRODUCTION

The reported global fisheries catch has been relatively stable since the late 80s, ranging between 86 and 93 million tonnes per year and peaking in 2018 with 96.4 million tonnes (FAO, 2020). The effective catch per unit of effort (CPUE) has consistently decreased since 1950, showing the increasing pressure of fisheries on ocean resources (Rousseau et al., 2019). However, there are signs of stabilization and more effective management in recent years, with a reduction in fleet sizes in developed countries (Rousseau et al., 2019). Management reforms have aimed to reduce fishing pressure and recover depleted stocks to biomass and exploitation rates that allow for maximum sustainable yield (Britten et al., 2014). Bottom trawling and purse seining used by the industrial fleet make up over 53% of all catches. In the artisanal sector, over 60% of catches were caught by gillnets, encircling nets and various line gears (Cashion et al., 2018). Artisanal fishing is often associated with fisheries on the continental shelf (0- to 200-m depth) catching pelagic and demersal fishes (Berkes et al., 2001; Colloca et al., 2004). The small-scale fleet in Europe relies more on coastal areas, predominantly employs passive gears with a multi-purpose fishing approach and can change the targeted fish species throughout the year (Guyader et al., 2012). The demersal fishery resources in tropical coastal areas consist of a wide range of species, relative to the highly productive off-shore temperate fisheries (Batista et al., 2014; Longhurst & Pauly, 1987). In the Canary Islands, most of the vessels use several types of gear, and the most common combination is by far set longlines (main gear) and traps, both used by 94% of the vessels (Popescu & Ortega, 2013). Demersal catches involve a larger workforce, generate greater economic benefits and encompass a variety of species with high commercial value (Pajuelo, 1997). In 2022, the Canary Islands recorded 741 registered vessels in the Operational Fishing Fleet, resulting in a total of 1,800,075 kg of demersal species landed at the first-sale points (MAPAMA, https://www.mapa.gob.es/).

Fish traps are extensively used in tropical and subtropical reef fisheries; one of their primary benefits is that they are highly specific, with little bycatch of non-target organisms, and also have considerably lower energy consumption per kilogramme (kg) landed than active fishing gear (Stevens, 2014; Thrane, 2004; Vadziutsina & Riera, 2020). The utilization of traps for capturing demersal species offers economic benefits and serves as a significant source of employment for certain coastal populations. Therefore, the conservation of these species plays a vital role in sustaining this activity (Vadziutsina & Riera, 2021). Fish traps represent the most prevalent fishing technique employed in Caribbean coral reefs and are extensively utilized in other tropical seas. This longstanding fishery has contributed to the sustenance, income and employment of numerous small-scale fishing communities (Agar et al., 2008; Gobert, 1998; Munro, 1974). In New South Wales, Australia, multispecies demersal fisheries employ traps for fishing, yielding landings of 700 tons, approximately representing US$3.5 million and providing employment for 400 fishermen (Stewart & Ferrell, 2003). Fish traps have been traditionally used in certain coastal areas of India, South Africa and the Arabian Gulf, being a significant portion of the coastal fishing effort (Felgate, 1965; Lee & Al-Baz, 1989; Nissa et al., 2021). In the south of Europe, especially in the Canary Islands, fish traps are the primary artisanal fishing gear deployed throughout the year (García-Mederos et al., 2015). The recorded landings at the first-sale points for this fishing gear type in 2022 were 323,503 kg in Gran Canaria, representing 60.3% of the total demersal species landed in this island (MAPAMA, n.d., https://www.mapa.gob.es/).

A previous study carried out in Gran Canaria showed that the main target species for the trap fishery between 2006 and 2011 were the pink dentex (*Dentex gibbosus*) and the planehead filefish (*Stephanolepis hispidus*) (González et al., 2012). Both species remain as the main target species in several sectors of the island despite the low values in the local market for *S. hispidus* (Mancera-Rodríguez, 2000). *D. gibbosus* exhibits a wide distribution across the Mediterranean and Atlantic coastlines, ranging from Portugal to Angola (Fernández-Palacios et al., 1994). Its capture occurs within depth ranges of 20–400 m, encompassing a variety of temperate to subtropical habitats. It is commonly found along the shelf on rocky and rubble bottoms, as well as on sandy substrates near rocks (Alves & Vasconcelos, 2012). Juvenile specimens predominantly inhabit coastal waters, and adults are prevalent in deeper regions, extending up to the limits of the continental shelf (Alves & Vasconcelos, 2012; Fernández-Palacios et al., 1994). As a carnivorous species, its diet primarily comprises teleosts, crustaceans and cephalopods (Bauchot et al., 1981; Bauchot & Hureau, 1986). *S. hispidus* is a benthic species known to inhabit rocky and sandy areas in shallow waters, extending to depths of up to 50 m. Its geographic range spans from New England to Brazil in the western Atlantic, as well as from Madeira archipelago to Angola in the eastern Atlantic (Harmelin-Vivien & Queró, 1990; Robins et al., 1986). *S. hispidus* is a benthic species that inhabits rocky and sandy areas in waters shallower than 50 m depth, from New England to Brazil (in the western Atlantic) and from the Madeira Islands to Angola (in the eastern Atlantic) (Harmelin-Vivien & Queró, 1990; Robins et al., 1986; Tortonese, 1986). This species is frequently encountered in a variety of seabed substrates, with a notable preference for rocky bottoms and meadows of *Cymodocea nodosa* (Brito, 1991). In Gran Canaria, it is commonly found in sandy areas and transitional zones (Franquet & Brito, 1995). As an omnivorous, the species exhibits a dietary preference for sea urchins, amphipods, hydrozoans, molluscs and plant material (Mancera-Rodríguez, 2000)). Notably, there is substantial trophic competition between juveniles and adults (Mancera 2000).

The increase of the number of traps resulted in a decline in the abundance of certain species, such as octopus in the town of Mogán (Hernández-García et al., 1998). Interviews with fishermen estimated an average of 275 traps per boat (Hernández-García et al., 1998). Despite the apparent reduction in the number of traps to 180 units per boat, a decline in nominal effort does not necessarily imply a similar reduction in effective fishing effort. Over these 10 years, technological improvements have been introduced in boats, potentially increasing fishing power and overall fishing mortality of the fleet (Couce-Montero, 2009). A progressive 93.3% decrease in CPUE values has been observed over 60 years (1950–2010) within the demersal artisanal trap fishery in the Canary Islands (Castro et al., 2019). In the 1970s, off the east and southwest coasts of Gran Canaria, the CPUE was reported as 2.2 kg trap$^{-1}$ day$^{-1}$ for the aggregate of caught species (Castro & Hernández-García, 2012). In 2009, CPUE values in the northeast sector of the island ranged between 0.14 and 0.18 kg trap$^{-1}$ day$^{-1}$ (García-Mederos et al., 2015). Harvey et al. (2012) conducted a study concluding that a diverse array of fishing gears is essential to understand habitat preferences across various life stages of the species. The spatial and temporal variations of the catches have considerable effects on catch composition and the relative impact on targeted species (Halvorsen et al., 2020). We analyse the spatial and temporal variability of the two main caught species of this fish artisanal trap fishery, that is, *D. gibbosus* and *S. hispidus*, from the island of Gran Canaria. In addition, the size distributions for both species were analysed in the two mesh types, large (50.8 mm) and small (31.6 mm), respectively. This study provides comprehensive information on the exploitation status of two of the main species caught in this fishery. It represents an improvement in knowledge towards implementing effective management measures to preserve and sustain commercially important species in the medium and long term.

## 2 | MATERIAL AND METHODS

### 2.1 | Study area

Data on catches of fish traps were obtained from five coastal areas in the island of Gran Canaria (Canary Islands, NE Atlantic Ocean). The port of San Cristóbal is located in the North-east (NE) of the island and the port of Taliarte in the East (E) with surrounding waters frequented by fishermen from both cooperatives; hence, the information from this area has been unified as a single sampling area. In the NE, fishing is mainly carried out in an area dominated by sandy sea bed a few covered by algae, similar to the E coast, where seabeds are also dominated by sandy substrates and sparse rocky areas. In both areas, the bathymetry drops sharply just a few metres from the coast, giving way to a reduced platform. Castillo del Romeral in the South-east (SE) of the island is mainly composed of sandy seabeds. Arguineguín is located in the South-southwest (S-SW) with a wide platform, dominated by sandy seabeds covered with vegetation, some rocky areas and seagrass meadows. In Mogán, the South-west (SW), the platform is quite reduced where sandy bare seabeds dominate and seagrass meadows are well represented. To position the catches in the fishing areas, as well as in the different types of substrates, the QGIS 3.24.2 software was used, and the biometric information of the eco-mapped area was obtained from the cartography provided by GRAFCAN (2008) (Figure 1).

### 2.2 | Data collection

The data collection spanned from October 2016 to September 2017, April and November 2018 and September 2020. The data were obtained with the assistance of 5 vessels located in the NE area (San Cristóbal and Melenara), 7 vessels in the SE area (Castillo del Romeral), 7 vessels in the S-SW area (Arguineguín) and 6 vessels in the SW (Mogán). A total of 291, 382, 1318 and 596 traps with small hexagonal mesh (31.6-mm mesh size) and an additional 38, 51, 7 and 45 traps with large hexagonal mesh (50.8-mm mesh size) were analysed in the NE, SE, S-SW and SW, respectively (Table 1). Two types of traps were employed, one with a circular shape and the other with a rectangular shape and were deployed individually or in ‘trap trains’. The total length, from end to end, of the fish traps with small mesh size typically ranged between 100 and 200 cm, and these traps typically have a single tunnel entrance, with an approximate maximum opening length of about 20 cm. They are deployed at depths ranging from shallow areas to 30 m. On the other hand, traps with large mesh size, which generally possess two tunnel entrances, each with an approximate maximum opening length of about 40 cm, have a total length ranging between 200 and 410 cm. These traps are deployed at depths ranging from 30 to 120 m. The effective fishing times (n° of setting days) can vary depending on factors such as the season, oceanographic conditions and target species. Traps with small mesh size were typically set with shorter soak times (from 2 to 28 days) compared with those with large mesh size (from 11 to 45 days). In some cases, bait such as small pelagic fish or bread was introduced into the traps to attract fish.

All marketable catches were transported to the port for subsequent identification, measurement (TL in mm) and weighing (total weight in g). Non-marketable catches, which lacked commercial interest or did not meet the legal minimum size based on regional (BOC, 1986) and national (BOE, 1995) regulations, were identified and measured on board before being promptly returned to the sea. For the two species, *D. gibbosus* and *S. hispidus*, the size at first maturity (SFM$_{50}$) are those according to González et al. (2012). The estimation of the biomass for these specimens was estimated from Length-Weight ratios in Fishbase (Froese & Pauly, 2019). The CPUE (‘marketable’ Catch Per Unit Effort), that is the specimens that

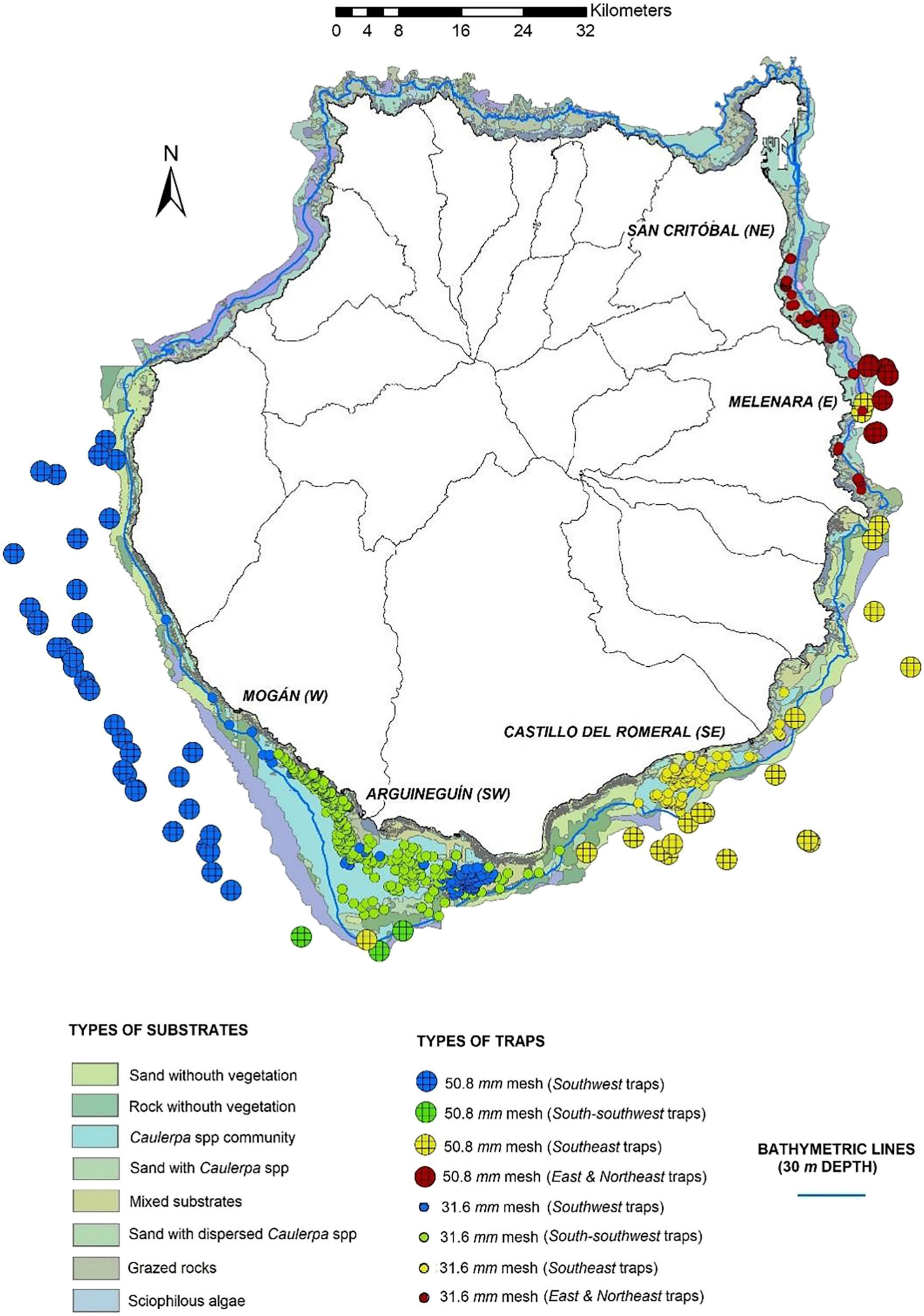

**FIGURE 1** Distribution of the different types of traps, large mesh size above 30 m and small mesh sizes below this depth, in the studied fishing areas, types of substrates and bathymetric line (30 m) in the island of Gran Canaria.

attained a size of 350 mm for *D. gibbosus* and exhibited no minimum size requirement for *S. hispidus*, were evaluated using a formula that correlates marketable catches for both species based on each trap type. The formula employed is CPUE = C (catches in grammes)/E (effort in soak days), which serves as the method for assessing the efficiency of each individual trap.

**TABLE 1** For *D. gibbosus* and *S. hispidus*, first maturity size (SFM50), size range in milimetres, size average in millimetres, total biomass in kilogrammes, numbers of specimens catched by the different types of traps in the fishing areas (*n*) in the large (*G*) and small fish traps (*P*) analysed above and below 30-m depth, respectively.

| | W; Mogán | | | | S-SW; Arguineguín | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Species | First maturity SFM50 (mm) | Size average (mm) | Biomass (kg) | *n* | Size range (mm) | Size average (mm) | Biomass (kg) | *n* | Mesh size |
| *Dentex gibbosus* | 350 | 477 | 1109.4 | 731 | 320–730 | 484 | 29.7 | 16 | *G* |
| *Stephanolepis hispidus* | 150 | 179 | 247.4 | 2718 | 100–373 | 181 | 760.2 | 7710 | *P* |

| | S-SE; Castilo del Romeral | | | | NE; Melenara & San Cristóbal | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Species | First maturity SFM50 (mm) | Size average (mm) | Biomass (kg) | *n* | Size range (mm) | Size average (mm) | Biomass (kg) | *n* | Mesh size |
| *D. gibbosus* | 350 | 519 | 185.8 | 85 | 350–730 | 502 | 54.1 | 33 | *G* |
| *S. hispidus* | 150 | 172 | 191.6 | 2219 | 100–310 | 186 | 29.5 | 248 | *P* |

## 2.3 | Statistical analysis

To determine significant differences between the sizes of specimens that reached maturity and those that did not, the Kolmogorov–Smirnov test was used. Multiple comparisons in the average lengths were performed for the two targeted species using a non-parametric test of Kruskal–Wallis for each location and also for the different months of the year. The same test was performed for the CPUE values analysed. Non-parametric Mann–Whitney *U* tests were employed to observe whether significant differences existed in the CPUE values between locations, across both reproductive and non-reproductive periods, as well as for catches obtained in substrates with the presence or absence of *Caulerpa* spp.

# 3 | RESULTS

## 3.1 | Catch composition

During the study period, a total of 865 specimens of *D. gibbosus* were collected using large traps positioned at depths exceeding 30 m, and 12,895 specimens of *S. hispidus* were collected using small traps positioned below the 30-m depth threshold. These specimens were collected across the four designated areas. The biomass obtained for each species was 1379 kg (*D. gibbosus*) and 1229 kg (*S. hispidus*) (Table 1). In terms of abundances, *D. gibbosus* accounted for 43.5% of the overall catches, and *S. hispidus* constituted 38.5%. The catches of *D. gibbosus* below 30-m depth in traps with a large mesh size, as well as those above this depth for the specimens of *S. hispidus*, were excluded from the analysis due to the small number of specimens catched, 52 and 71, respectively. Due to limited bionomic information below the bathymetric level of 30 m, substrate types were determined for only 11.9% of *D. gibbosus* specimens, whereas for *S. hispidus*, 95.9% of the catches were situated within the eco-mapped zone. For *D. gibbosus*, 70.9% of specimens were found in sandy substrates, and the remaining 29.1% were located in grazed rocks and mixed substrates. In the case of *S. hispidus*, 81.5% of the specimens were catched in sandy substrates with the presence of *Caulerpa* spp. For this species in Mogán, Arguineguín and Castillo del Romeral, the percentage of specimens caught in substrates with the presence of *Caulerpa* spp was higher than in others where it was not present, with values of 63.7%, 89.1% and 88.8%, respectively. However, in Melenara & San Cristóbal, the highest percentages were represented in sandy substrates without vegetation, comprising 52.8% of the catches (Figure 1).

The size of first maturity was specifically established at 373 mm for *D. gibbosus* and 149 mm for *S. hispidus*, according to the findings reported by González, Pajuelo, et al. (2012). Only 1% of the specimens of *D. gibbosus* catched in traps with a small mesh size below 30 m reached the size at first maturity. In contrast, 100% of the specimens of *S. hispidus* catched in traps with a large mesh size above 30 m reached the size of first maturity. In all localities, the average catch length consistently exceeded the first maturity size for the large mesh traps set above 30 m and the small mesh traps positioned below this depth (Figure 2). For both species, this represented 81.16% and 90.86% of individuals that reached or surpassed the size at first maturity, showing significant differences between the lengths of the catched specimens ($Z = 11.501$, $p = 0.000$ and $Z = 32.916$, $p = 0.000$, respectively). The large mesh size for *D. gibbosus* specimens obtained average lengths of 477, 484, 519, and 502 mm in Mogán, Arguineguín, Castillo del Romeral and Melenara & San Cristóbal areas, respectively (Table 1). Significant differences were observed between the lengths of the specimens caught in the different localities ($F = 10.218$, $p = 0.017$), and comparisons showed significant differences between the catches from Mogán and Castillo del Romeral ($Z = -2.691$, $p = 0.007$) but not for the remaining localities. For the *S. hispidus* catches, the small mesh size obtained average lengths of 179, 181, 172 and 188 mm, respectively, in the sampled localities (Table 1). Significant differences were observed between the lengths of the specimens caught in the different localities, except for Arguineguín and Melenara & San Cristóbal ($Z = -1.577$, $p = 0.115$).

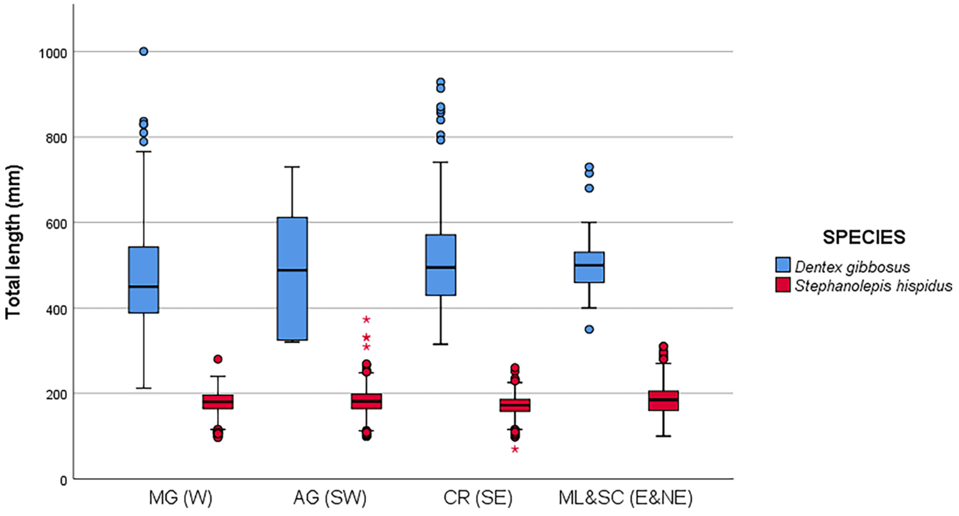

**FIGURE 2** Total length of the specimens of *Dentex gibbosus* catched using large mesh traps deployed above 30 m and *Stephanolepis hispidus* in small mesh traps set below this depth for the fishing areas.

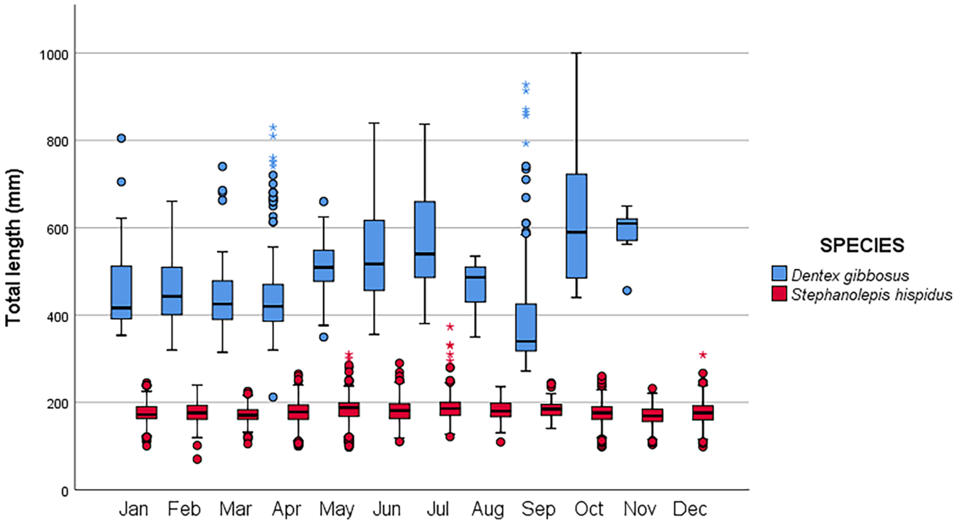

**FIGURE 3** Total length of the specimens of *Dentex gibbosus* catched using large mesh traps deployed above 30 m and *Stephanolepis hispidus* in small mesh traps set below this depth, for each month of the year during the study period.

Throughout the entire year, within the specified depth ranges mentioned above, the average sizes of *D. gibbosus* exhibited values exceeding 500 mm in May (506 mm), June (537 mm), July (563 mm), October (629 mm) and November (588 mm) (Figure 3). Significant differences were found in the set of specimens caught along the different months of the year ($F = 259.414$, $p = 0.000$). For *D. gibbosus*, the reproductive months from April to September coincide with temperatures reaching 21–22°C (Pajuelo & Lorenzo, 1995); the average length was 489 mm and decreased to 463 mm in the non-reproductive months. Significant differences were found in the size of specimens caught during the reproductive and non-reproductive months for this species ($Z = -2.437$, $p = 0.015$). In the case of *S. hispidus*, the values that exceeded sizes above 180 mm were obtained during May (183 mm), June (180 mm), July (185 mm), August (182 mm) and September (185 mm) (Figure 3). Significant differences were found in the set of specimens caught along the different months of the year ($F = 442.315$, $p = 0.000$). During the reproductive months, from May to November according to Mancera-Rodríguez & Castro-Hernández (2015b), the catch length average was 181 mm, and the values decreased to 176 mm in the non-reproductive months. Significant differences were found during the reproductive and non-reproductive months for this species ($Z = -12.479$, $p = 0.000$).

## 3.2 | Fishing efficiency

The most profiteable 'marketable' catches of *D. gibbosus* were mainly recorded at depths over 30 m specially in large mesh size traps; the CPUE average above 30 m was 344.2 g trap$^{-1}$ day$^{-1}$ with a sharp fishing efficiency decrease in shallow areas, with CPUE values of 24.3 g trap$^{-1}$ day$^{-1}$ below 30 m. In particular, the area with the highest profit in traps with a large mesh size for *D. gibbosus* was Mogán (CPUE: 857.7 g trap$^{-1}$ day$^{-1}$), consistent with deeper areas of exploitation, followed by Arguineguín, Castillo del Romeral and Melenara & San Cristóbal (Table 2). Significant differences were observed between 'marketable' catches per effort unit among the studied localities ($F = 30.740$, $p = 0.000$), namely between Mogán

**TABLE 2** For *Dentex gibbosus* caught using large mesh traps deployed above 30 m and for *Stephanolepis hispidus* caught in small mesh traps set below this depth in different fishing areas and months, the average capture depth, number of traps hauled up (*n*), CPUE average values (g/traps/days) and standard deviation were recorded.

| | ***Dentex gibbosus* (large mesh size)** | | | | ***Stephanolepis hispidus* (small mesh size)** | | | |
|---|---|---|---|---|---|---|---|---|
| **Area** | **Depth average (m)** | ***n* (traps)** | **CPUE average (grammes/traps/days)** | **Standard deviation** | **Depth average (m)** | ***n* (traps)** | **CPUE average (grammes/traps/days)** | **Standard deviation** |
| Mogán | 91.8 | 45 | 857.7 | 1502 | 19.2 | 596 | 64.3 | 85 |
| Arguineguín | 88 | 7 | 190.1 | 429 | 21.6 | 1318 | 102.9 | 134 |
| Castillo del Romeral | 62.3 | 51 | 124 | 365 | 22.8 | 382 | 124.9 | 154 |
| Melenara & San Cristóbal | 51.2 | 38 | 59.9 | 158 | 20.3 | 291 | 12.1 | 31 |

| | ***D. gibbosus* (large mesh size)** | | | | ***S. hispidus* (small mesh size)** | | | |
|---|---|---|---|---|---|---|---|---|
| **Months** | **Depth average (m)** | ***n* (traps)** | **CPUE average (grammes/traps/days)** | **Standard deviation** | **Depth average (m)** | ***n* (traps)** | **CPUE average (grammes/traps/days)** | **Standard deviation** |
| January | 73.3 | 9 | 242.1 | 412 | 23.2 | 196 | 77.1 | 121 |
| February | 67.1 | 11 | 267.3 | 301 | 21.6 | 94 | 19.4 | 33 |
| March | 59.3 | 7 | 377 | 743 | 19.6 | 188 | 56.8 | 71 |
| April | 90.9 | 7 | 962.8 | 825 | 20.8 | 464 | 98.8 | 164 |
| May | 77 | 8 | 316.4 | 366 | 20.6 | 418 | 94.7 | 111 |
| June | 85.6 | 17 | 865.5 | 2154 | 22.1 | 231 | 165.9 | 148 |
| July | 90.6 | 22 | 464.6 | 1042 | 20.2 | 201 | 82.2 | 115 |
| August | 66.8 | 19 | 50.5 | 104 | 20.6 | 172 | 84.5 | 98 |
| September | 75.7 | 19 | 180 | 537 | 21.4 | 138 | 3.1 | 11 |
| October | 57.1 | 18 | 65.4 | 158 | 21.3 | 188 | 85.9 | 117 |
| November | 91.5 | 4 | 252.9 | 480 | 25.5 | 99 | 105.6 | 133 |
| December | - | - | - | - | 20.4 | 198 | 79.5 | 91 |

Abbreviation: CPUE, catch per unit of effort.

and Castillo del Romeral ($Z = -4.482$, $p = 0.000$) and Mogán and Melenara & San Cristóbal ($Z = -4.727$, $p = 0.000$). The remaining comparisons between locations did not show any significant differences. *S. hispidus* has no minimum catch legal size; therefore, all the catches were considered 'marketable', and the catches trends were the opposite, with fewer numbers of traps raised over 30 m, where the CPUE average in small mesh size traps was 66.6 g trap$^{-1}$ day$^{-1}$; above this depth the average reached 87.1 g trap$^{-1}$ day$^{-1}$. The locality with the highest profit of traps with small mesh size for *S. hispidus* was Castillo del Romeral (CPUE: 124.9 g trap$^{-1}$ day$^{-1}$) followed by Arguineguín, Mogán and Melenara & San Cristóbal, respectively (Table 2). Significant differences were observed in the set of the CPUE ($F = 287.574$, $p = 0.000$), and the comparisons between the localities did not show any significant differences.

The CPUEs were conducted by considering the seasonality of the 'marketable' catches for both species, as observed within the specified depth ranges detailed above. Regarding the annual variations of the CPUE, both species peaked at the end of spring and the beginning of the summer season. For *D. gibbosus*, during the reproductive months, the CPUEs obtained were 962.8, 316.4, 865.5, 464.6, 50.5 and 180.0 g trap$^{-1}$ day$^{-1}$, from April to September, respectively, with a decrease in October (65.4 g trap$^{-1}$ day$^{-1}$), rising in November (252.9 g trap$^{-1}$ day$^{-1}$) with no recorded catches in December, because no traps were raised along this month, and with values of 242.1 and 267.3 g trap$^{-1}$ day$^{-1}$ during January and February, respectively (Table 2). No significant differences were observed in the CPUE values along the different months ($F = 16.838$, $p = 0.078$). During the set of reproductive months, the CPUE values were 419.4 g trap$^{-1}$ day$^{-1}$, and for the non-reproductive months, the values decreased to 203.0 g trap$^{-1}$ day$^{-1}$; however, no significant differences were found in the catches during the reproductive and non-reproductive months for this species ($Z = -0.610$, $p = 0.542$).

For *S. hispidus*, the CPUE values from April to November were 98.8, 94.7, 165.9, 82.2, 84.5, 3.1, 85.9 and 105.6 g trap$^{-1}$ day$^{-1}$, respectively, decreasing from December to March with values of 79.5, 77.1, 19.4 and 56.8 g trap$^{-1}$ day$^{-1}$, respectively (Table 2). Significant differences were observed between the CPUE values along the different months ($F = 317.693$, $p = 0.000$). During the set of reproductive months, the CPUE was 94.0 g trap$^{-1}$ day$^{-1}$, and for the non-reproductive months, it decreased to 78.2 g trap$^{-1}$ day$^{-1}$. Significant differences were found during the reproductive and non-reproductive months for this species ($Z = -3.005$, $p = 0.003$).

If we take into account only those traps that obtained 'marketable' catches, inside the echo-mapped area, the highest CPUE in traps with catches of *D. gibbosus* (332.7 g $\text{trap}^{-1}$ $\text{day}^{-1}$) belonged to sandy substrates. However, the number of traps analysed is not sufficient to provide conclusive results. For *S. hispidus* inside the echo-mapped area, the highest CPUE were recorded in substrates with *Caulerpa* spp, representing values of 112.6 g $\text{trap}^{-1}$ $\text{day}^{-1}$ compared with 87.1 g $\text{trap}^{-1}$ $\text{day}^{-1}$ obtained on substrates with no *Caulerpa* spp. Significant differences were observed between the catches obtained in these two substrates ($Z = -3.977$, $p = 0.000$).

## 4 | DISCUSSION

The mesh size of traps is a pivotal factor influencing fish capture (Mahon & Hunte, 2001). Traps equipped with a smaller mesh size demonstrate a significantly higher efficacy in capturing specimens compared with those with larger mesh sizes. This is primarily attributed to the diminished likelihood of escape in traps featuring a smaller mesh size. In the case of the large mesh size, specimens of *D. gibbosus* exhibited a mean catch length above the age of first maturity across all studied localities (Table 1). However, the use of the small mesh size resulted in high catch ratios of specimens that did not reach the size of first maturity. Conversely, for *S. hispidus*, the small mesh size demonstrated high selectivity, with the mean length of caught specimens surpassing the age at first maturity in the surveyed areas (Table 1). This observation highlights how two commercially important species, sharing part of the same ecological niche, are catched using different mesh sizes on the island of Gran Canaria. Within large mesh size traps, *D. gibbosus* catches in western locations had a lower mean length compared with those in the eastern side of the island (Figure 2). Significant differences were noted between catches in Mogán (SW) and Castillo del Romeral (SE), suggesting potentially higher fishing pressure in the western areas of the island. Furthermore, the abundance of large *S. hispidus* specimens in the NE area of the island is higher than in the rest of the study areas (Figure 2). Significant differences were observed between the average lengths of specimens caught in Melenara & San Cristóbal (NE) and the remaining areas, except for Arguineguín (S-SW), which exhibited similar values but with smaller sizes. The present findings align with earlier studies (García-Mederos et al., 2015; Mancera-Rodríguez, 2000), revealing that a majority of specimens surpassing 149 mm were catched in the eastern regions of the island. This pattern suggests a potential lower fishing pressure in these areas.

The distribution and abundance of adults of *D. gibbosus* and *S. hispidus* on Gran Canaria Island have been determined through catches obtained in traps. The CPUE for *D. gibbosus* was higher in Arguineguín (S-SW) and especially in Mogán (SW) where the depths of catch were consistently higher, with significant differences observed between Mogán and the eastern localities (Castillo del Romeral and Melenara & San Cristóbal). For *S. hispidus*, the CPUE was higher in southern areas (Arguineguín and Castillo del Romeral) relative to the remaining sampling fishing localities (Table 2). Marketable catches per unit effort decreased significantly below and above 30-m depth for *D. gibbosus* (large-mesh traps) and for *S. hispidus* (small-mesh traps), respectively. The results for these two demersal species suggest that fishing efficiency varies based on factors such as catch depth and substrate type. On the island of Gran Canaria, herbivores significantly reduce the quantity of plant material in mixed meadows dominated by *Caulerpa prolifera* and *C. nodosa*, with a notable emphasis on the former species (Del Río et al., 2016). In the case of *S. hispidus*, the ingestion of algae, primarily *C. prolifera*, may occur as a consequence of feeding on epibiontic fauna, such as hydroids, amphipods or gastropods. Notably, individuals exceeding 12.9 cm in size demonstrate an increased consumption of echinoids, algae and lamelibranchs (Mancera-Rodríguez & Castro-Hernández, 2015a). Consistent with the findings of the aforementioned study, adult specimens of this species exhibit a notable preference for habitats characterized by sandy substrates with the presence of *Caulerpa* spp. As observed in the results (Table 2), the CPUE values are higher in southern localities, such as Arguinegín and Castillo del Romeral, where the predominant communities belong to *Caulerpa* spp. (Figure 1).

In the Canary Islands, the peak reproduction of *D. gibbosus* occurs between April and September. This reproductive peak is likely associated with both sea temperature and photoperiod, as indicated by Pajuelo & Lorenzo (1995). Similarly, in the Madeira Archipelago, reproductive periods align with the boreal spring to summer, specifically from April to August, according to Alves et al. (2011). In alignment with these findings, the temporal distributions of catches revealed two peaks, occurring in April and June. This pattern suggests the susceptibility of this species to traps during the spawning months. Through a study utilizing traps in the bottom reef areas off the coasts of Maryland and northern Virginia, it was observed that specimens of black sea bass (*Centropristis striata*) are catched in low abundance at all depths during late summer (Eklund & Targett, 1991). The diminished catch rates during this period are likely attributable to the fish's relatively inactive or non-migratory behaviour (Eklund & Targett, 1991). For *D. gibbosus*, there were no significant differences observed between catches obtained during the reproductive period (April–September) and non-reproductive periods. However, significant differences were noted in the mean sizes of the catches between both periods, indicating an aggregation of larger specimens during the reproductive months. According to Mancera-Rodríguez & Castro-Hernández (2015b), the spawning period for *S. hispidus* in the Canary Islands occurs from May to November, with a peak in summer (July–August). During this period, the concentration of adults is more accessible to the fish traps, and hence, most of the highest number of catches occur. In the present study along the reproductive and non-reproductive periods, significant differences were observed in the catches of *S. hispidus*. Our data are similar to those of Mancera-Rodríguez (2000), where the CPUE increased between May–July and in December, and the highest abundances were obtained here in June and November. The results showed a grouping of large-sized specimens along the reproductive periods for both species, because there are significant differences in the sizes of the caught specimens during the spawning season and the rest of the months.

In multispecies reef fisheries, establishing a singular optimal mesh size for harvesting a diverse range of fish species is challenging due to variations in their sizes and body shapes. A substantial reduction in mesh size would not only result in an overall decline in catches but also selectively exclude smaller-sized species (Vadziutsina & Riera, 2020). The inappropriate use of fish traps has the potential to impact species sharing the same ecological niche. In this study, we specifically analyse the catchability of two fish species with differing morphologies and sizes, yet sharing the same habitat and being targeted by the same fishing gear. Consequently, on the basis of these findings, we propose considering changes in trap usage contingent on mesh size and depth range:

a. The recent shift of fishing effort towards deeper areas, as observed in the Mogán area, among other factors, may be attributed to the depletion of resources in more accessible locations. This depletion could lead to a displacement of adults specimens towards deeper areas, potentially resulting in an escalating effort towards increasingly deeper zones, which, if unchecked, could contribute to resource depletion. To mitigate this, the implementation of a maximum depth limit is recommended for the use of large mesh size traps. This suggestion is particularly relevant due to the high catchability of spawners of *D. gibbosus* in deeper areas. Such a measure would not only help in preserving the resource but also contribute to the protection of circalittoral areas. A study conducted on the Portuguese coast revealed that the impact of artisanal fisheries on circalittoral corals is potentially more significant than previously assumed (Dias et al., 2020). Hence, it is crucial to recognize that fishing gears coming into contact with the seafloor can have substantial impacts on highly sensitive deep-sea coral communities.
b. The current findings, along with previous studies (García-Mederos et al., 2015), indicate a notably low 'marketable' capture value for *D. gibbosus* in traps with small mesh sizes across all depths. The use of small-mesh traps in deeper areas may be considered detrimental to this species but advantageous for catching species such as *S. hispidus* in shallow areas. Hence, it is recommended to restrict the use of small-mesh traps at medium-high depths to avoid capturing juveniles of species like *D. gibbosus*. A precedent for such a measure can be found in the West Atlantic coasts, where the use of fish traps was prohibited in federal waters three miles offshore between North Carolina and Florida in 1988. Small traps targeting black sea bass were an exception to the ban (NOAA Marine Debris Program, 2015).

To accurately determine the depth limits of different types of traps and ensure the sustainable exploitation of targeted species, it is recommended to conduct future studies, taking into account the specific set of target species on the island of Gran Canaria. The proposed management measures outlined here may not lead to an improvement in the current situation of resource depletion unless accompanied by a reduction in the number of traps. Concentrating the same level of effort in smaller areas could potentially have negative consequences for the resources. Positioning systems for certain fishing gear are measures currently pending implementation in the Canary Islands. Monitoring the traps would facilitate surveillance and control measures to effectively carry out the previously proposed measures. Henceforth, the utilization of catches obtained in traps, integrated into updated biometrics of the Canary Islands, could serve as an effective approach to comprehensively understand habitat preferences across diverse life stages of demersal species. Furthermore, it is recommended to review the sizes at first maturity of both species ($SFM_{50}$) and suggest a minimum catch size for *S. hispidus* to preserve juveniles. This study represents a significant stride towards a comprehensive examination of fish traps in the Canary Islands. The data collection, spanning from 2016 to 2020, ensures a continuous and reliable source of information for in-depth analysis and understanding of the subject.

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## CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## REFERENCES

Agar, J.J., Waters, J.R., Valdés-Pizzini, M., Shivlani, M., Murray, T., Kirkley, J.E. et al. (2008). U.S. Caribbean fish traps fishery socioeconomics study. *Bulletin of Marine Science. Miami*, 82(3), 315–331. https://scholarworks.wm.edu/vimsarticles/1506

Alves, A., Faria, G., Reis, R., Pinto, A.R. & Vieira, S. (2011). Aspects of reproduction in pink dentex *Dentex gibbosus* (Rafinesque, 1810) from the Archipelago of Madeira in the northeast Atlantic. *Arquipelago. Life* *and Marine Sciences*, 28, 71–82. https://www.researchgate.net/publication/273644235

Alves, A. & Vasconcelos, J. (2012). Age and growth of the pink dentex *Dentex gibbosus* (Rafinesque, 1810) caught off the Madeira Archipelago. *Arquipelago. Life and Marine Sciences*, 30, 1–9. https://www.researchgate.net/publication/273380994

Batista, V.S., Fabré, N., Malhado, A.C.M. & Ladle, R.J. (2014). Tropical artisanal coastal fisheries: challenges and future directions. *Reviews in Fisheries Science & Aquaculture*, 22(1), 1–15. https://doi.org/10.1080/10641262.2013.822463

Bauchot, M.L. & Hureau, J.C. (1986). Sparidae. In: Whitehead, P.J.P., Bauchot, M.L., Hureau, J.C., Nielsen, J.C., & Tortonese, E. (Eds.) *Fishes of the northeastern Atlantic and the Mediterranean*. Paris: UNESCO, pp. 883–907.

Bauchot, M.L., Hureau, J.C. & Miquel, J.C. (1981). Sparidae. In: Fischer, W. et al. (Eds.) *Fiches FAO d'identification des espèces pour les besoins de la pêche. Atlantique centre-est; zones de pêche 37 et 42 (en partie)*, Vol. IV. Canada: FAO, pp. 41–81.

Berkes, F., Mahon, R., McConney, P., Pollnac, R. & Pomeroy, R. (2001). *Managing small-scale fisheries: alternative directions and methods*. Canada: International Development Research Center. Chapter 1.

BOC. (1986) *Decreto 155/1986, de 9 de octubre, por el que se establecen las tallas mínimas para la captura de peces en aguas interiores del Archipiélago Canario*. BOC N° 125, 3p.

BOE-A-1995–8639. (1995) *Real Decreto 560/1995, de 7 de abril, por el que se establecen las tallas mínimas de determinadas especies pesqueras*. BOE N° 84, 3p.

Brito, A. (1991). *Catálogo de los peces de las Islas Canarias*. Santa Cruz de Tenerife: Francisco Lemus Editor. 230 p.

Britten, G.L., Dowd, M., Minto, C., Ferretti, F., Boero, F. & Lotze, H.K. (2014). Predator decline leads to decreased stability in a coastal fish community. *Ecology Letters*, 17(12), 1518–1525. https://doi.org/10.1111/ele.12354

Cashion, T., Al-Abdulrazzak, D., Belhabib, D., Derrick, B., Divovich, E., Moutopoulos, D.K. et al. (2018). Reconstructing global marine fishing gear use: catches and landed values by gear type and sector. *Fisheries Research*, 206, 57–64. https://doi.org/10.1016/j.fishres.2018.04.010

Castro, J.J., Divovich, E., de Molina, D., Acevedo, A., Barrera-Luján, A. & Riera, R. (2019). Reconstruction of marine small-scale fisheries captures in the Canary Islands (NE Atlantic Ocean) from 1950 to 2010. *Scientia Marina*, 83(1), 7–17. https://doi.org/10.3989/scimar.04837.18A

Castro, J.J. & Hernández-García, V. (2012). *Caracterización del poder de pesca de la flota artesanal canaria, con especial referencia a la fracción con eslora superior a 12m y análisis del estado de los recursos que explota*. Viceconsejería de Pesca del Gobierno de Canarias: Informe Técnico, p. 127.

Colloca, F., Crespi, V., Cerasi, S. & Coppola, S.R. (2004). Structure and evolution of the artisanal fishery in the Southern Italian coastal area. *Fisheries Research*, 69(3), 359–369. https://doi.org/10.1016/j.fishres.2004.06.014

Couce-Montero, M.L. (2009). *Diagnosis de la pesquería artesanal en el Puerto de Mogán*. Tesina de Máster: Universidad de las Palmas de Gran Canaria. 37 p.

Del Río, L., Vidal, J., Betancor, S. & Tuya, F. (2016). Differences in herbivory intensity between the seagrass *Cymodocea nodosa* inhabiting the same habitat. *Aquatic Botany*, 128, 48–57. http://hdl.handle.net/10553/49559

Dias, V., Oliveira, F., Boavida, J., Serrão, E.A., Gonçalves, J.M.S. & Coelho, M.A.G. (2020). High coral bycatch in bottom-set gillnet coastal fisheries reveals rich coral habitats in southern Portugal. *Frontiers in Marine Science*, 7, 603438. https://doi.org/10.3389/fmars.2020.603438

Eklund, A.M. & Targett, T.E. (1991). Seasonality offish catch rates and species composition from the hard bottom trap fishery in the middle Atlantic bight (US east coast). *Fisheries Research*, 12, 1–22. https://doi.org/10.1016/0165-7836(91)90045-H

FAO. (2020). *INFORM*, Vol. 32, Issue 6: American Oil Chemists Society, pp. 6–10. https://doi.org/10.4060/ca9229en

Felgate, W.S. (1965). *An ecological study of the Tembe Thonga of Natal and Mozambique*Unpublished report on research work edited by EJ. Krige, pp. 1–168.

Fernández-Palacios, H., Montero, D., Socorro, J. & Vergara, J.M. (1994). First studies on spawning, embryonic and larval development of *Dentex gibbosus* (Rafkesque, 1810) (Osteichthyes, Sparidae) under controlled conditions. *Aquaculture*, 122(1), 63–73. https://doi.org/10.1016/0044-8486(94)90334-4

Franquet, F. & Brito, A. (1995). *Especies de interés pesquero de Canarias*. Gobierno de Canarias: Consejena de Pesca y Transportes. 143 p.

Froese, R. & Pauly, D. (2019). *FishBase, version (12/2019)*: World Wide Web electronic publication. Available from: http://www.fishbase.org

García-Mederos, A.M., Tuya, F. & Tuset, V.M. (2015). The structure of a nearshore fish assemblage at an oceanic island: insight from small scale fisheries through bottom traps at Gran Canary Island (Canary Islands, eastern Atlantic). *Aquatic Living Resources*, 28, 1–10. https://doi.org/10.1051/alr/2015002

Gobert, B. (1998). Density-dependent size selectivity in Antillean fish traps. *Fisheries Research*, 38(2), 159–167. https://doi.org/10.1016/S0165-7836(98)00119-2

González, J.A., Capote, E., Triay, R., Santana, J.I. & Pajuelo, J.G. (2012). *Proyecto NASA 75 Invierno: Estudio complementario sobre el impacto de las nasas para peces en gran Canaria*Memoria final. Las Palmas de Gran Canaria: Universidad de Las Palmas de Gran Canaria. 400p.

González, J.A., Pajuelo, J.G., Lorenzo, J.M., Santana, J.I., Tuset, V., Jiménez, S. et al. (2012). *Talla mínima de captura: peces, crustáceos y moluscos de interés pesquero en Canarias: una propuesta científica para su conservación*. Ganadería, Pesca y Alimentación: Consejería de Agricultura. 248 pp.

GRAFCAN. (2008) *Cartográfica de Canarias, S.A.* www.grafcan.es

Guyader, O., Berthou, P., Koutsikopoulos, C., Alband, F., Demanèche, S., Gaspar, M.B. et al. (2012). Small scale fisheries in Europe: a comparative analysis based on a selection of case studies. *Fisheries Research*, 140, 1–13. https://doi.org/10.1016/j.fishres.2012.11.008

Halvorsen, K.T., Sørdalen, T.K., Larsen, T., Browman, H.I., Rafoss, T., Albretsen, J. et al. (2020). Mind the depth: the vertical dimension of a small-scale coastal fishery shapes selection on species, size, and sex in wrasses. *Marine and Coastal Fisheries Dynamics Management and Ecosystem Science*, 12(6), 404–422. https://doi.org/10.1002/mcf2.10131

Harmelin-Vivien, M.L. & Queró, J.C. (1990). Monacanthidae. In: Queró, J.C., Hureau, J.C., Karrer, C., Post, A., & Saldanha, L. (Eds.) *Checklist of the fishes of the eastern tropical Atlantic*, Vol. II, Junta Nacional de Investigaçao Científica e Tecnológica. Paris: European Ichthyological Union, Paris and United Nations Educational, Scientific and Cultural Organization, pp. 1061–1066.

Harvey, E., Newman, S.J., Mclean, D., Cappo, M., Meeuwig, J. & Skepper, C.L. (2012). Comparison of the relative efficiencies of stereo-BRUVs and traps for sampling tropical continental shelf demersal fishes. *Fisheries Research*, 125-126, 108–120. https://doi.org/10.1016/j.fishres.2012.01.026

Hernández-García, V., Hernández-López, J.L. & Castro, J.J. (1998). The octopus (Octopus vulgaris) in the smallscale trap fishery off the Canary Islands (Central-East Atlantic). *Fisheries Research*, 35, 183–189. https://doi.org/10.1016/S0165-7836(98)00080-0

Lee, J.U. & Al-Baz, A.F. (1989). Assessment of fish stocks exploited by fish traps in the Arabian Gulf area. *Asian Fisheries Science*, 2, 213–231. https://doi.org/10.33997/j.afs.1989.2.2.007

Longhurst, A.R. & Pauly, D. (1987). *Ecology of tropical oceans*. San Diego: Academic Press, p. 407.

Mahon, R. & Hunte, W. (2001). Trap mesh selectivity and the management of reef fishes. *Fish and Fisheries*, 2(4), 356–375. https://doi.org/10.1046/j.1467-2960.2001.00054.x

Mancera-Rodríguez, N.J. (2000). *Estudio de la biología, ecología y pesquería de Stephanolepis hispidus (Linnaeus, 1766) (Pisces: Monacanthidae) en aguas de Canarias*. Tesis Doctoral: Universidad de Las Palmas de Gran Canaria. 302 p.

Mancera-Rodríguez, N.J. & Castro-Hernández, J.J. (2015a). Feeding ecology of the planehead filefish *Stephanolepis hispidus* (Pisces: Monacanthidae), in the Canary Islands area. *Revista de Biología Marina y Oceanografía*, 50(2), 221–234. https://doi.org/10.4067/S0718-19572015000300002

Mancera-Rodríguez, N.J. & Castro-Hernández, J.J. (2015b). Reproductive biology of the planehead filefish *Stephanolepis hispidus* (Pisces: Monacanthidae), in the Canary Islands area. *Ichthyological Research*, 62, 258–267. https://www.researchgate.net/publication/281558921

MAPAMA, https://www.mapa.gob.es/

Munro, J.L. (1974). The mode of operation of Antillean fish traps and the relationships between ingress, escapement, catch and soak. *ICES Journal of Marine Science*, 35, 1974(3), 337–350. https://doi.org/10.1093/icesjms/35.3.337

Nissa, A., Lekshmi, N.M., Kumar, M.B., Das, E.P. & Goud, A. (2021). Structural and operational aspects of fishing traps of Meghalaya, north East India. *Fishery Technology*, 58, 147–154.

NOAA Marine Debris Program. (2015). *Report on the impacts of "ghost fishing" via derelict fishing gear*. Silver Spring, MD: NOAA. 25p.

Pajuelo, J.G. (1997). *La pesquería artesanal canaria de especies demersales: Análisis y ensayo de dos modelos de evaluación*. Tesis Doctoral: Universidad de Las Palmas de Gran Canaria. p. 347. http://hdl.handle.net/10553/1916

Pajuelo, J.G. & Lorenzo, J.M. (1995). Biological parameters reflecting the current state of the exploited pink dentex *Dentex gibbosus* (Pisces: Sparidae) population off the Canary Islands. *South African Journal of Marine Science*, 16(1), 311–319. https://doi.org/10.2989/025776195784156421

Popescu, I. & Ortega, J.J.G. (2013). Fisheries in the Canary Islands. In: *Policy department B: structural and cohesion policies European Parliament*. pp. 56. https://www.europarl.europa.eu/studies/

Robins, C.R., Ray, G.C., Douglass, J. & Freund, R. (1986). *A field guide to Atlantic coast fishes*. Boston: Houghton Mifflin Company.

Rousseau, Y., Watson, R.A., Blanchard, J.L. & Fulton, E.A. (2019). Evolution of global marine fishing fleets and the response of fished resources. *PNAS*, 116(25), 12238–12243. https://doi.org/10.1073/pnas.1820344116

Stevens, B.G. (2014). Impacts of fishing on king crabs: bycatch, injuries, and mortality. In king crabs of the world. *Biology and Fisheries Management. Chapter*, 12, 363–402.

Stewart, J. & Ferrell, D.J. (2003). Mesh selectivity in the New South Wales demersal trap fishery. *Fisheries Research*, 59, 379–392. https://doi.org/10.1016/S0165-7836(02)00024-3

Thrane, M. (2004). Energy consumption in the Danish fishery: identification of key factors. *Journal of Industrial Ecology*, 8(1–2), 223–239. https://doi.org/10.1162/1088198041269427

Tortonese, E. (1986). Monacanthidae. In: Whitehead, P.J.P., Bauchot, M.L., Hureau, J.C., Nielsen, J., & Turtonese, E. (Eds.) *Fishes of the North-eastern Atlantic and the Mediterranean*. Paris: UNESCO, pp. 1338–1339.

Vadziutsina, M. & Riera, R. (2020). Review of fish trap fisheries from tropical and subtropical reefs: Main features, threats and management solutions. *Fisheries Research*, 223, 105432. https://doi.org/10.1016/j.fishres.2019.105432

Vadziutsina, M. & Riera, R. (2021). Artisanal and small-scale fish trap fisheries from tropical and subtropical reefs: targeted species and conservation of fish stocks. *Journal of Fisheries and Environment*, 45(2), 69–83. https://li01.tci-thaijo.org/index.php/JFE/article/view/247386

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